

# POPULATION DYNAMICS, GROUP STRUCTURE AND NATURAL DISPERSAL OF THE ASIATIC LION *PANTHERA LEO PERSICA*<sup>1</sup>

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(With one text-figure)

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The Gir forest in the Saurashtra region of Gujarat is synonymous with the Asiatic lion. Recognising the serious danger to the lion and the pitiable condition of the tribal Gir Maldharis in 1972, the Gir Lion Sanctuary Project was implemented for five years which resulted in the improvement of habitat and wildlife. Lion numbers increased from 177 in 1968 to 304 in 1995. Availability of major ungulates increased from 53.5 ungulates per lion to 125.9 ungulates per lion. Studies indicate that the food preference has changed to wild animal from 25% in 1972 to 65% in 1990. Improvement of the Gir forests and increase in wildlife population have brought major changes in social behaviour and reduction in size of groups of lions. The Asiatic lion started migrating from Gir to the neighbouring forests in search of food and space. Dispersal paths of the Asiatic lion at present are almost similar to the extinction path adopted during the beginning of this century. There are four satellite populations of lions in Girnar, Mitiyala and coastal forests outside the Gir. It has become necessary to expand the present Gir forests to new areas by covering Girnar, Mitiyala, Barda, coastal forests and grasslands to manage the increasing lion population as well as to maintain the ecological security of the region.

## Asiatic Lion and the Gir

Gir is the single largest tract of forest in the Saurashtra region of Gujarat State and is synonymous with the Asiatic lion, *Panthera leo persica*. The lion entered India from the west and was found in large numbers in the states of Punjab, Haryana, Rajasthan, Uttar Pradesh, Madhya Pradesh, Gujarat and western Bihar. The last lion surviving in the wild outside Saurashtra was killed in 1884.

The Gir forest in Saurashtra has shrunk from 3070 sq. km in the 1880s to 1884 sq. km at present due to expansion of agriculture, and destruction of the habitat. In the early part of this century, the Gir was connected with Girnar, Mitiyala, Barda, Alech hills, Dhank and Chorwad by corridors of rough semi-wooded forests, grasslands and sparsely populated villages. This enabled the lions to move freely in the region.

Lions deserted the Barda and Alech hills towards the latter half of the 19th century, and disappeared from Girnar and Mitiyala by 1963 and 1955 respectively. At the time of notification of Gir forests as a Lion Sanctuary in 1965, lions were found only in the compact forest of the Gir. Gradually, the size of wildlife protected area increased to 1412 sq. km with the national park surrounded by the sanctuary. The rest of the 403 sq. km peripheral forests constitute the buffer zone of the wildlife reserve.

The most important aspect of the Gir is that it has become a very stable ecosystem with tremendous regenerating, self supporting, and sustaining capacity due to its rich and diverse flora and fauna. The Gir is an unique ecosystem which harbours over 400 plant, 32 mammal, 24 reptile, over 310 bird, and more than 2000 insect species, along with a number of micro-flora and fauna.

## Conservation Measures to Save Lion

A study by Dr. Paul Joslin (1972) revealed that the Gir displayed an overwhelming evidence of

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accelerated degradation of the ecosystem, and warned that if nothing was done to arrest the rate of decline in the number of surviving Asiatic lions, the species would be extinct within two decades.

Recognising the serious danger to the lion and the pitiable condition of the Maldharis, the Gir Lion Sanctuary Project, a five year scheme was prepared in 1972, and the same was implemented at a total cost of Rs 58 lakhs. The work carried out under the project was: (i) fencing of the sanctuary by constructing a rubble wall 400 km along its periphery, (ii) constructing barricades along the water course traversing the periphery of the sanctuary, (iii) establishing check posts with barriers across all public roads passing through the sanctuary, and (iv) shifting of all Maldhari families from the national park, and majority of the families from the sanctuary, and resettling them outside the sanctuary by allotting cultivable lands, grazing land and house sites. Out of 845 Maldhari families, about two-thirds have been resettled at different sites.

Serious problems like grazing, poaching, lopping, illicit cutting etc. were tackled by the Forest Department and development programmes like soil and moisture conservation, habitat improvement, plantation etc. were implemented during the period. The degradation of the Gir ecosystem was reversed and habitats improved in the park and sanctuary. Many parts of the Gir have become dense since the launching of the project. Construction of water harvesting structures and artificial water holes has increased the availability of water to the wildlife.

### Increase in Wildlife Population and Change in Food Pattern

The Gir habitat has improved since the declaration of the sanctuary. Implementation of the Gir Lion Sanctuary Project has resulted in increased availability of food and water. Six consecutive censuses have been conducted at an interval of five years since the declaration of the sanctuary. The lion population, along with other wild animals, has increased consistently. Figures of the last six censuses are given in Table 1.

TABLE 1  
GROWTH OF WILDLIFE POPULATION IN THE GIR

Year	Lion	Leopard	Hyena	Herbivores (ungulates)	No. of ungulates per lion
1968	177	NA*	NA*	NA*	NA*
1974	180	142	63	9635	53.5
1979	205	161	84	14964	73.0
1985	239	201	192	16905	70.7
1990	284	212	97	31489	110.9
1995	304	268	137	38221	125.9

\*NA: Not available

Herbivores in Table 1 include only six major species i.e. Chital, Sambar, Bluebull, Chinkara, Four horned Antelope and Wild boar. There has been a consistent increase in the carnivores and herbivores. Availability of ungulates number per lion has increased from 53.5 in 1974 to 125.7 in 1995 which makes wild kills easily available for carnivores.

Ungulate habitat relationship in the Gir has been studied by Berwick (1974). Joslin (1972) has investigated the Gir ecology and behaviour of the lions. Joslin (1972) reported that atleast 75% of the lion food came from livestock, mainly buffaloes and 25% from the wild herbivores. Gradual positive development took place during the last two decades and the ungulate population increased more than five fold. The study of Ravi Cheilam (1993) has indicated that the food pattern of the lion has changed in favour of wild prey, as 65% of the lion diet was recorded as wild animals whereas 35% was made up of livestock kills.

### Group Structure & Size

Lions are social animals with strong familial ties, they usually live and hunt in family groups. The size of groups recorded in the Gir was large in the past because live bait was provided for the lion show. This practice was stopped in 1987 and group size above a dozen is rarely seen at present.

304 lions were located at 94 sites on live bait during the last day of the lion census in May 1995, against 284 lions at 59 location in 1990. All

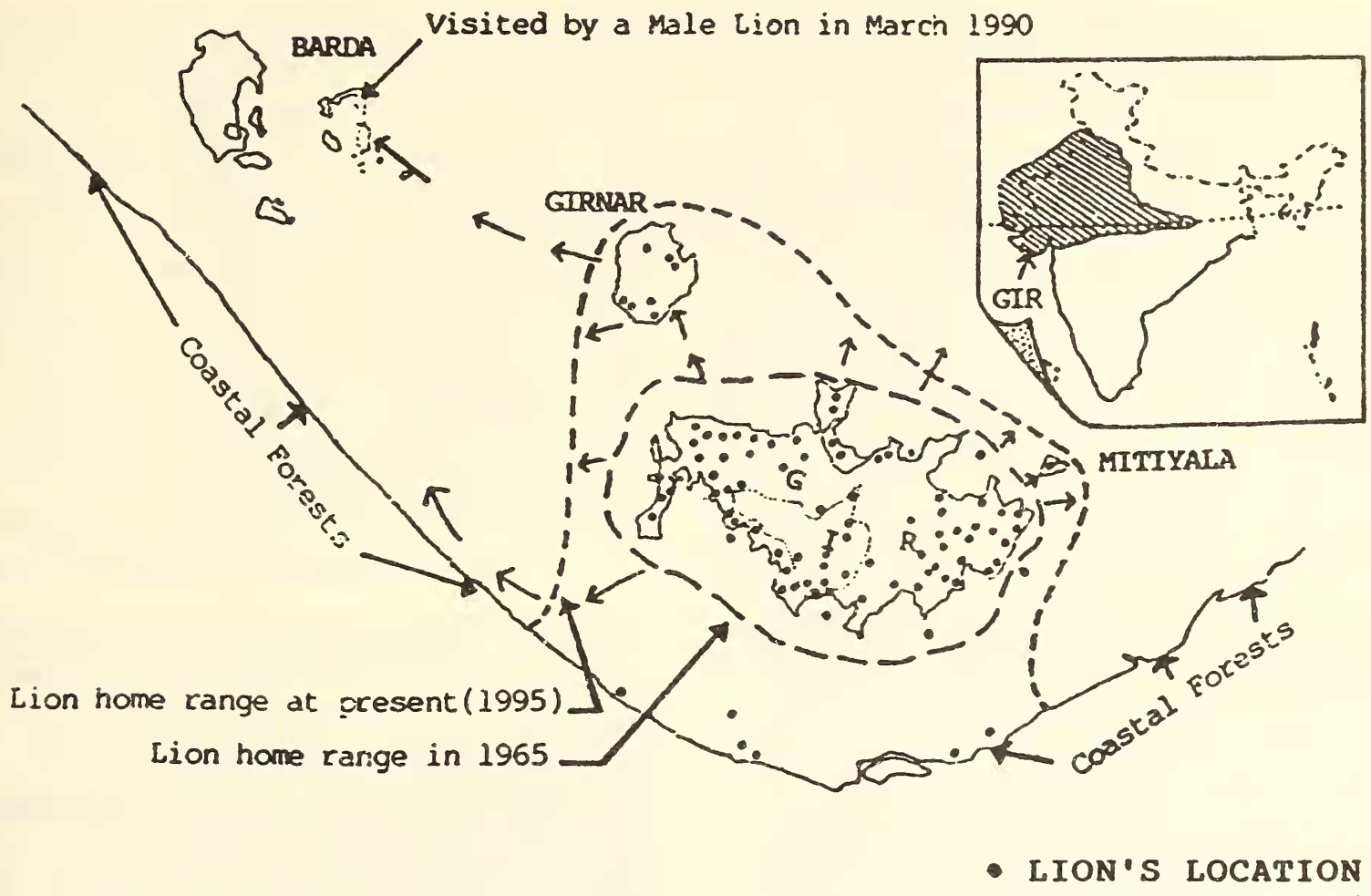


Fig. 1. Distribution of Asiatic lion in the Gir (India) in the 19th century and at present

groupings were natural except a group in Babara zone in which two or three groups of the same pride merged to form a big group of 15 at the bait site. Different types of composition of groups recorded during the census are given in Table 2.

The following findings have emerged after analysis of census data:

1. Single males were observed at 15 sites which was maximum among the five types of group structure. Pure male groups were found singly or in pairs except in one location where three males came to the bait site.
2. Location sites for a single male, two males, single female, and pairs were largest among different types of group structure
3. Single females were located at seven sites and some of them were very old.
4. Most of the male-female pairs were mating pairs or subadults
5. Large groups of animals were found in mixed

groups with one male, and a few females and cubs.

6. Pure groups of males were not seen with any cubs.
7. Average group size in May, 1995 census was smaller than the size recorded during census in May, 1990.
8. Number of lion locations increased from 59 in 1990 to 94 in 1995.

Live bait may have caused artificial grouping at a few sites but such grouping was mostly limited to animals which normally share food at kills.

#### Natural Dispersal/Migration of Lions

Lions disappeared from the neighbouring forests outside the Gir, during the middle of this century. Habitat of the Gir improved, and the lion population gradually grew with increased level of protection and conservation. Before the census in

TABLE 2  
GROUP STRUCTURE OF ASIATIC LION OBSERVED DURING LAST TWO CENSUSES

Group Composition	No. of animals	May, 1995		No. of locations	May, 1990	
		Average group size	Range of group size		Average group size	Range of group size
1	2	3	4	5	6	7
Pure male	33	1.42	1-3	24	1.40	1-3
Pure Female	17	1.55	1-3	11	1.38	1-2
Male & Female	87	3.37	2-8	26	4.62	2-11
Female & cub	73	4.05	2-9	18	6.75	4-10
Mixed group (Male, female & cubs)	94	6.27	3-15	15	11.3	3-28
<b>Total/Average</b>	<b>304</b>	<b>3.23</b>	<b>1-15</b>	<b>94</b>	<b>4.81</b>	<b>1-28</b>

1990, lions were occasional visitors to Girnar, Mitiyala and coastal forests but they started visiting neighbouring forests again. The situation has changed since then and this carnivore has started moving into former territories. Prides of lions have occupied Girnar, Mitiyala and the coastal forests permanently. At present, there are four satellite populations of lions. The second generation of migrated lion has made Girnar and the coastal forests its home range. Dispersal paths of the Asiatic lion at present are almost similar to the extinction path adopted during the beginning of this century and may follow similar trends till they reach other new areas.

It has been observed that the majority of the migrated lions were sub-adults, probably they were compelled by dominant males to leave the pride and territory. Wild lions in Girnar were often attracted by the roaring of captive lions kept in the Sakkarbaug zoo maintained by the Forest Department on the outskirts of Junagadh town in 1950. This was repeated after 40 years when two male lions regularly visited spacious lion enclosures constructed recently in the adjacent forest for breeding programmes, 4 lions were recorded in 1990 which have increased to 13 as per the census conducted in May, 1995.

A long strip of coastal plantation supports a small population of Bluebull and Wild boar. One pride of 16 lions in Kodinar Dhamrej Sutrapada and another of 10 lions in Rajula and Jafarabad depends

on cattle and Bluebull. Lions were brought back to the Gir in the past but they repeatedly migrated to coastal forests in search of food and territory and settled permanently in these areas after 1990. The fourth satellite population of lion is in the Mitiyala forests of Bhavnagar Forest Division, and is in the process of settling there permanently. The distribution of the lion population in the Gir and extended Gir is given in Table 3.

TABLE 3  
DISTRIBUTION OF LIONS IN DIFFERENT AREAS  
LION CENSUS - MAY, 1995

Sr. No.	Site	Lion Population			Total
		Male	Female	Cubs	
1	Gir	92	109	61	262
1.1	National Park	10	12	9	31
1.2	Sanctuary	72	92	50	214
1.3	Peripheral forests	10	5	2	17
2.	Girnar	10	3	-	13
3.	Mitiyala	2	1	-	3
4.	Kodinar-Sutrapada coastal forests	5	6	5	16
5.	Una-Rajula- Jafarabad coastal forests	3	2	5	10
		112	121	71	304

The number of lions outside the Gir is known as the floating population because some of them visit the above zones for short periods and come back to their original areas. Table 3 indicates that 42 lions

including 10 cubs stay outside the Gir. It also indicates that the population of lions staying outside the protected area (PA) may keep on increasing under the existing protection level.

All four sites have a low herbivore count, therefore the migrant lions primarily depend on domestic livestock kills. The trend of dispersal still continues, as a lion made a kill in a grass vidi near Barda forests in 1990 and stayed there for 36 days. If this trend continues, the growing population from Girnar and the coastal forests may reach new areas in Saurashtra. In Barda forests, only improved prey-base and habitat might attract the lions to make this area another home for themselves.

### Carrying Capacity of the Gir

The carrying capacity of an area depends on the availability of food, water, conduciveness to reproduction and space. Food is not a major limiting factor in the Gir as the population of important ungulates increased at the rate of 14.2% per year during the last three decades, but shortage of space may result in territorial fighting and migration. The population has remained almost at the same level (267 in 1990 and 262 in 1995) in the national park and sanctuary during last two censuses. Positive changes in the habitat may improve this figure marginally, but the growing population of the big cat can be managed through improving habitats in new areas naturally preferred by the lions.

The natural dispersal of the lion started after the last drought in 1987. 17 lions were recorded outside the Gir in 1990 which increased to 42 in 1995 but the number of the animal remained constant in the PA during the last two censuses. Thus, present levels of the lion population within the PA may be the carrying capacity of the park and sanctuary.

### Need of Conservation Strategy

*Panthera leo persica* is a key indicator species which should decide the ecological boundary of the Gir. Against this background, the concept of management of the Greater Gir Ecosystem or

extended Gir in new territories of lions has become the need of the hour in the interest of nature conservation and management of increasing lion population. Proper strategies should be designed for management of forests along with grasslands, wastelands to expand Gir forests from 1814 sq.km at present to 2370 sq.km in the near future by covering Girnar (179.5 sq. km), Mitiyala (19.4 sq. km), coastal forests (110.1 sq. km), Barda (187.4 sq. km) and vidis (approx. 60 sq. km). In addition to the forest lands, wastelands, and panchayat lands connecting Gir, the above forests, should be developed and managed as corridors for lions. Entire forests of Junagadh and Amreli districts should be managed as Greater Gir Forests under a unified administrative set up.

The following measures are required to be adopted as a part of the management strategy.

1. Habitat of the Gir should be improved and expanded by arresting the degradation of peripheral forests and wastelands.
2. For a better life outside the sanctuary, facilities should be created to attract the Maldharis who are residing inside the sanctuary without basic facilities.
3. Satellite population at four sites should be managed by increasing the prey base.
4. Girnar and coastal forests should be conserved and herbivore population should be increased to meet the requirement of the growing population of lions.
5. Barda forest, which was selected as an alternative home for the lion in 1979 should be rehabilitated and prey base should be increased by taking up breeding programmes of herbivores.
6. For herbivores, *in situ* breeding programme should be developed to increase the ungulate population in Girnar, Mitilaya and the coastal forests.
7. Necessary management practices should be followed to facilitate natural migration of lions in new area. Problem animals should be removed from the wild population and these should be utilised for breeding purposes in zoos.

8. Management of Girnar, Barda, Mitiyala, coastal forests and other neighbouring forests should be integrated with the management of the Gir. The concept of the Greater Gir Ecosystem Management should be evolved, not only for the conservation of the Asiatic lion but also to provide ecological security to the region. Management of wasteland, panchayat lands, grasslands and forests connecting Gir to new habitats should be covered under a management plan for a Greater Gir Ecosystem.

POPULATION OF WILDLIFE IN THE GIR  
WILDLIFE CENSUS, MAY 1995

Species	Common name	Population
1. <i>Panthera leo persica</i>	Lion	304
2. <i>Panthera pardus</i>	Leopard	268
3. <i>Hyaena hyaena</i>	Striped Hyena	137
4. <i>Axis axis</i>	Chital	32061
5. <i>Cervus unicolor</i>	Sambar	2262
6. <i>Boselaphus tragocamelus</i>	Bluebull	1856
7. <i>Gazella gazella</i>	Chinkara	441
8. <i>Tetracerus quadricornis</i>	Four horned antelope	387
9. <i>Sus scrofa</i>	Indian Wild boar	1214

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